Robotics Traveling Van – 1st Hardware Status Update

33% Milestone Check-in

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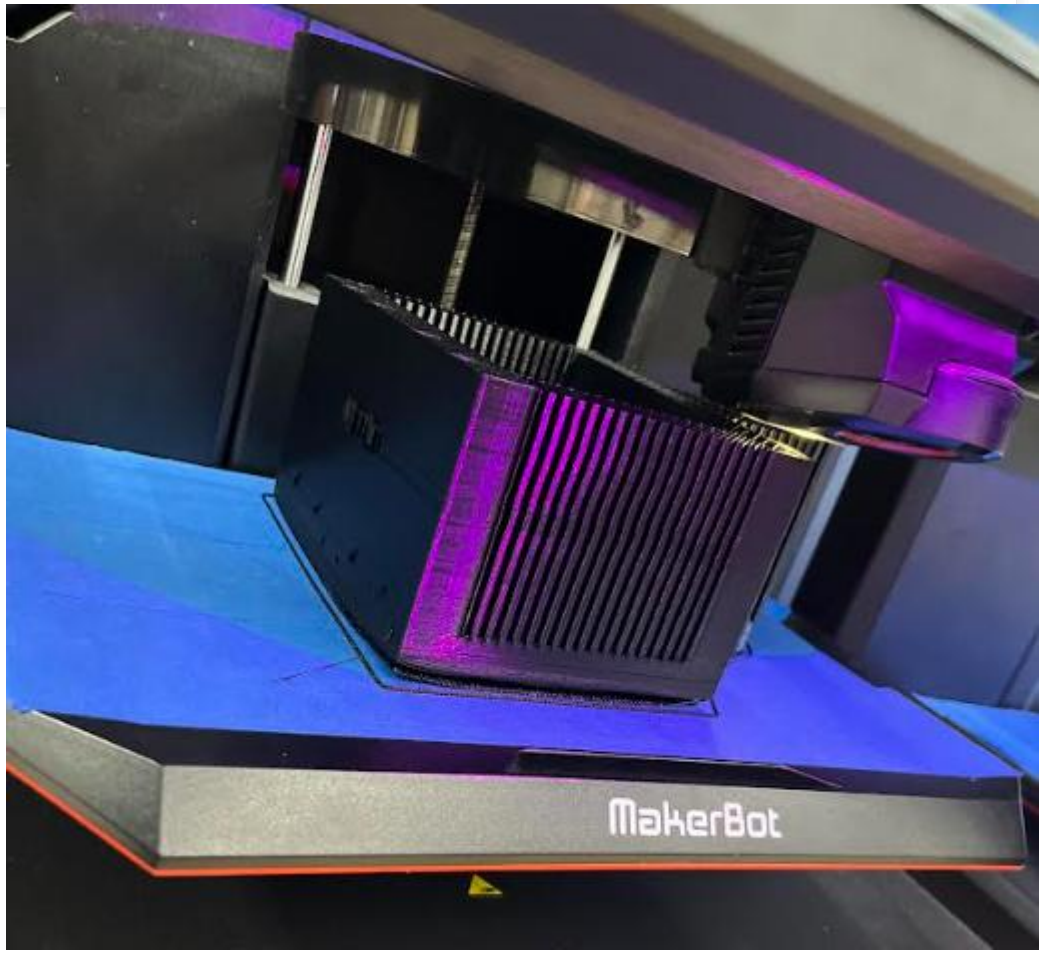
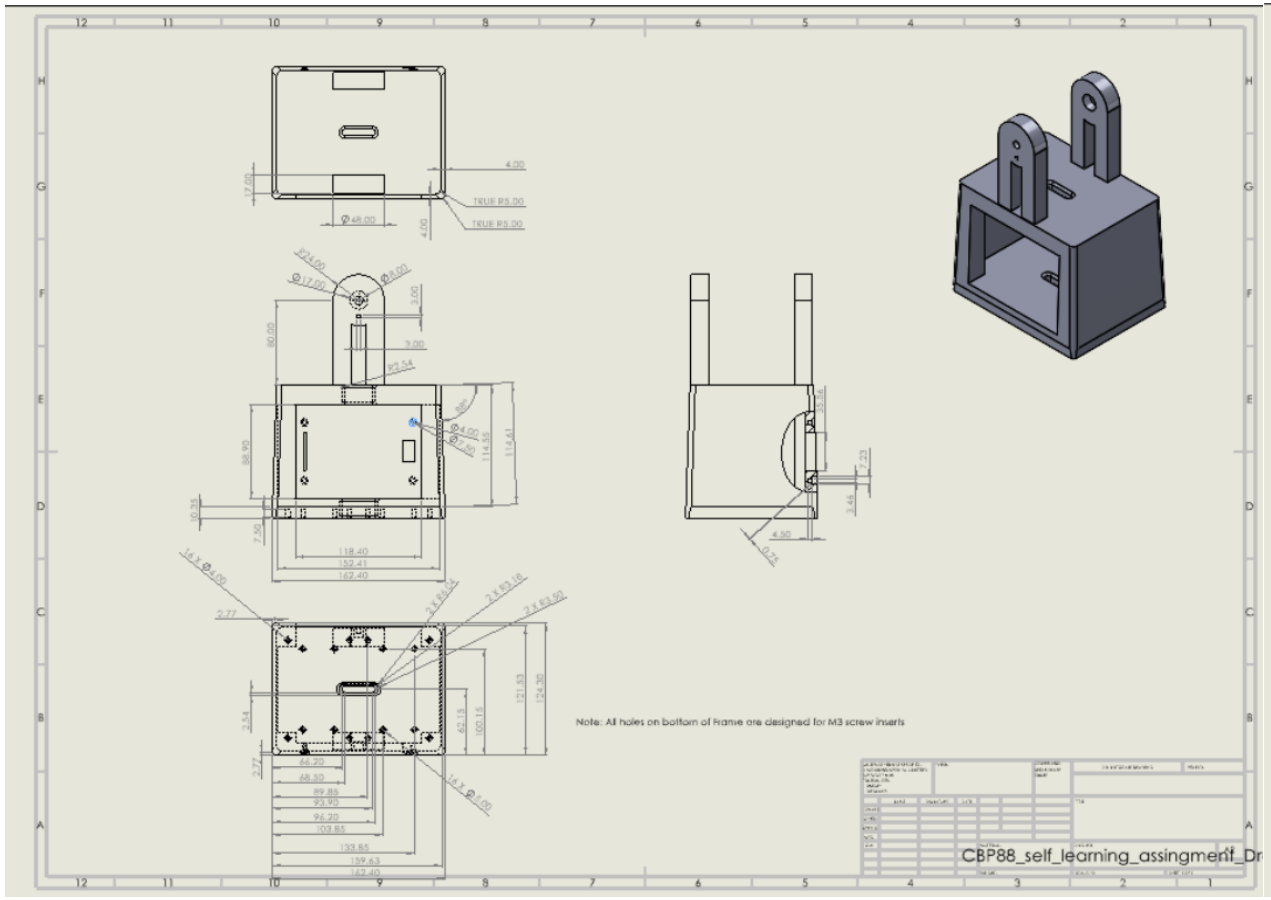
2/5/26

Design Efforts – Robot 1 (Inverted Pendulum)

- Sensor change (pot => mag)
- Frame height (shorter)
- CAD design (bearing holes, inserts)
- Steel vs. aluminum pendulum



Updated CAD


Note: All holes on bottom of Frame are designed for M3 screw inserts
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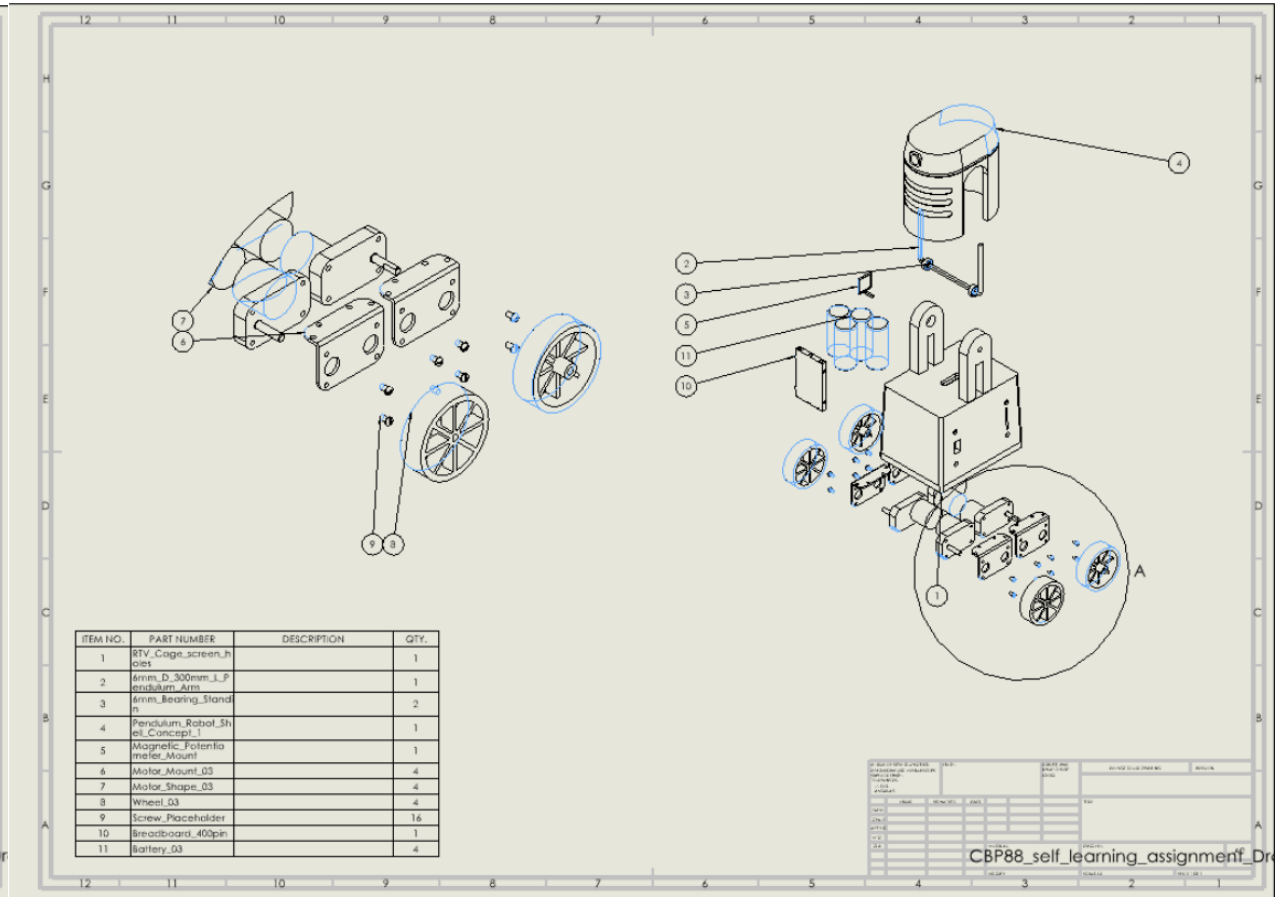

ITEM NO. | PART NUMBER | DESCRIPTION | QTY.
1 | RTV_Cage_screen_holes | | 1
2 | 6mm_D_300mm_L_Pendulum_Arm | | 1
3 | 6mm_Bearing_Standin | | 2
4 | Pendulum_Robot_Sheil_Concept_1 | | 1
5 | Magnetic_Potentiometer_Mount | | 1
6 | Motor_Mount_03 | | 4
7 | Motor_Shape_03 | | 4
8 | Wheel_03 | | 4
9 | Screw_Placeholder | | 16
10 | Breadboard_400pin | | 1
11 | Battery_03 | | 4
A
CBP88_self_learning_assignment_Dr

Purchasing Plan – Robot 1

Parts Ordered

	Parts for 5 Units			Purchased		In Stock	Cost
Mech	20	motors		0%	(not all the same)	20%	49.95
	20	wheels		0%		60%	-
	10	bearings		100%		100%	8.49
	5	Al rods		100%		80%	11.99
	# kg	filament		200%	order kg 1	80%	22.99
	100	screws		100%		100%	21.99
	100	M3 long		100%		100%	9.49
	100	M3 short		0%		0%	9.99
Electrical	5	PicoPi		60%		3%	12.99
	5	protoboard		100%		100%	5.99
	5	buck converter		100%		100%	8.69
	10	motor drivers		100%		60%	25.98
	#	wire		100%		100%	9.99
	20	batteries		40%		60%	159.95
	5	chargers		40%		100%	72.95
	5	mag. encoders		100%		100%	44.95
	5	BMS		80%		60%	44.95
UI	5	Touchscreen		40%		0%	104.95
	5	power cords		0%		0%	49.95
			% total	72%	% total	64%	

Parts Received

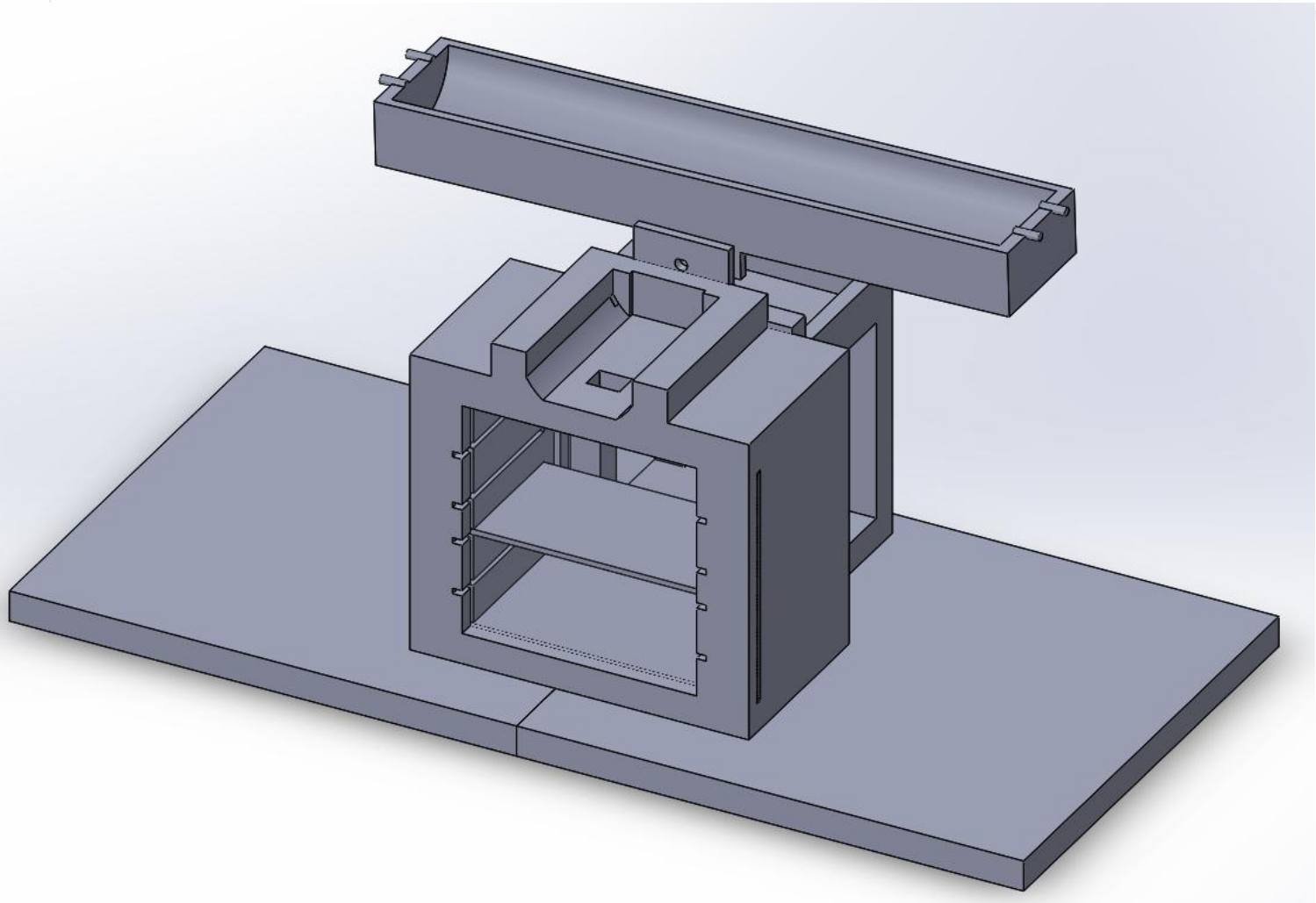
Pick Up Date	PART	QTY
02.02.2026	ArduCam	2
	Touchscreen	3
	Battery (4 pck)	4
	Dip socket kit	1
	RP2040 (3 pck)	2
	StpMtr Pts (4 pck)	1
	Stp Mtr	2
	Pin Rows	1
	Mtr Drv (3 pck)	2
	4S30A (2 pck)	1
	Bck Cnvrtr (5 pck)	2
	Thrd Insrt (long)	1
	M3 x 8mm	1
	Encdr (3 pck)	2
	Bearings	1
	Bttry Adptr	3
	Steel Rods	1

Manufacturing Plan – Robot 1

Next steps:
1) Print more frames
2) Solder complete robot
3) Produce 5 units

	Numbers for 5 unit total count (1/5 done)						Logic for two robots done
		Status			Status		Status
Parts Printed			**Parts Machined**			Assembly	
Frame		20%	Pendulum		20%		40%*
	Print Time	20 hrs		Bend time	1 hrs	Assemble/Solder	7hrs
							Status
					*=	Electrical parts	
						Protoboards	20%
						Batteries cells	40%
						Sensors	0%
						Programming	80%

Design Efforts – Robot 2 (Ball-on-Beam)



- Mechanical Architecture: Finalized "Motor-at-Axis" pivot design.
- Sensor Integration: Custom sensor cylinders designed for modularity and professional finish.
- Safety: Integrated hard stops to prevent over-rotation.

Purchasing Plan – Robot 2

Spring 2026	Qty Type	Qty	Price per	Price Total	Buy or Mfd	Status	Vendor	Manuf.
22 AWG Hookup Wire	Unit	1	15.29	15.29	Buy	RECEIVED	Amazon	TUOFENG
Dupont Jumper Wire Set	Unit	1	6.98	6.98	Buy	RECEIVED	Amazon	Elegoo
Header Pins	Unit	1	7.39	7.39	Buy	RECEIVED	Amazon	MCIGICM
M3 Brass Heat-Set Inserts	Pack	1	0	0	Buy	RECEIVED	Amazon	Ruthex
M3 x 20mm Socket Head Screws	Pack	1	5	5	Buy	RECEIVED	Home Dep	Everbilt
NEMA 17 Stepper Motor 12 V	Unit	3	14.99	44.97	Buy	RECEIVED	Amazon	STEPPERO
PLA Filament (1.75mm) 2-Pack	Roll	1	35.99	35.99	Buy	RECEIVED	Amazon	Creality
Protoboard	Unit	1	13.59	13.59	Buy	RECEIVED	Amazon	DEYUE
Stepper Motor Driver TMC2208	Unit	1	17.99	17.99	Buy	RECEIVED	Amazon	Generic (D
2pcs 4S 30A 14.8V Li-ion Lithium 18650 Battery BMS	Unit	1	8.99	8.99	Buy	RECEIVED	Amazon	Anmbest /
3.3V Buck Converter Module	Unit	1	8.69	8.69	Buy	ORDERED	Amazon	DONGKE
4 Pack 3.2v 32700 LiFePO4 Batteries	Unit	1	31.99	31.99	Buy	RECEIVED	Amazon	CITYORK
4.0 Inch 320x480 TN Capacitive Touch Screen	Unit	1	20.99	20.99	Buy	RECEIVED	Amazon	Hosyond
DZZ Clear Acrylic Photo Picture Frames Display Picture	Unit	1	9.99	9.99	Buy	RECEIVED	Amazon	DZZ
LiFePO4 Battery Charger	Unit	1	14.59	14.59	Buy	ORDERED	Amazon	HTRC / Ge
RP2040 Core Board	Unit	1	12.99	12.99	Buy	RECEIVED	Amazon	Waveshare
VL53L0X Time-of-Flight Sensor	Unit	1	12.99	12.99	Buy	RECEIVED	Amazon (L	Qoroos

Category	Total Items	Received	Ordered (Pending)	Completion %
Electronics & Power	8	7	1	87.50%
Control & Logic	4	3	1	75.00%
Structure & Hardware	5	5	0	100.00%
TOTAL PROJECT	17	15	2	88.20%

Project Allocation: $1,500.00

Unit Construction Cost: $238.44

Cost Breakdown (Per Unit):

- Power (4S LiFePO4): ~$64.00
- Touch Interface: ~$42.00
- Structure (Filament): ~$11.00
- Control & Drive: ~$60.00
- Hardware/Misc: ~$63.00

Status: Significantly under the $1,500 cap

Manufacturing Plan – Robot 2

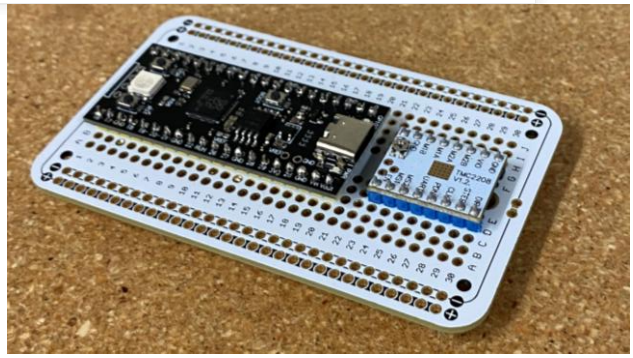
Part Name	Already Manufactured	Currently Manufactured	Future Manufactured	Qty.	Source
Central Hub				1/5	3D
Electrical & Motor Cubby			2/9 - 2/13	0/5	3D
Axel Pin				1/5	3D
Trough Beam				1/5	3D
Base 1			2/9 - 2/18	0/5	3D
Base 2			2/9 - 2/18	0/5	3D
Shelf		2/5 - 2/7		0/5	3D
Acrylic Door		2/7 - 2/ 10		0/5	Amazon

- Method: High-Fidelity 3D Printing (PLA+/PETG) to ensure professional aesthetic.
- Upcoming: Full assembly scheduled (Library Printing Plan in place).

	Manufacturing Status *for one unit*	
Manufactured (printing)	4/8 parts = 50% completed	+90 hrs
Assembled	3/8 parts = 37.5% completed	2 hrs

Manufacturing Plan – Robot 2

1. Power System Assembly (Status: In Progress)
   - Energy Storage Unit: 4x LiFePO4 cells successfully soldered in 4S Series configuration (12.8V).
   - Safety Hardware: Battery Management System (BMS) acquired and bench-verified; scheduled for pack integration during next lab session.
   - Physical Status: Raw battery pack assembled; BMS termination pending.
2. Control Hardware
   - Hardwired Logic: RP2040 Microcontroller permanently soldered to main protoboard.
   - Motor Drive: Stepper drivers wired with 1/16 microstepping jumpers installed.



Subsystem	Manufacturing Task	Status	Labor Hours	% Complete
Power Plant	Cell Balance Testing (Pre-Solder)	Done	1.0 hrs	100%
	4S Pack Soldering & Spot Welding	In Progress	1.5 hrs	40%
	BMS Integration & Safety Checks	Pending	0.0 hrs	0%
Control Logic	MCU Pin Header Soldering	Done	0.5 hrs	100%
	Protoboard Circuit Layout Design	Done	1.0 hrs	100%
	Driver Wiring & Signal Routing	In Progress	0.5 hrs	25%
TOTALS	Phase 1 Electrical Fabrication	STARTED	4.5 Total	~35%

Manufacturing Plan – Robot 2

3. Firmware Logic

- Control Algorithm: Implemented AUTOMATIC PID mode with defined microstep output limits (SetOutputLimits) to prevent mechanical over-travel.
- Sensor Loop: System performs continuous millimeter-level distance polling (readRangeContinuousMillimeters) to drive the error calculation.
- Actuation: Control output is cast directly to target_step_pos for immediate motor response.

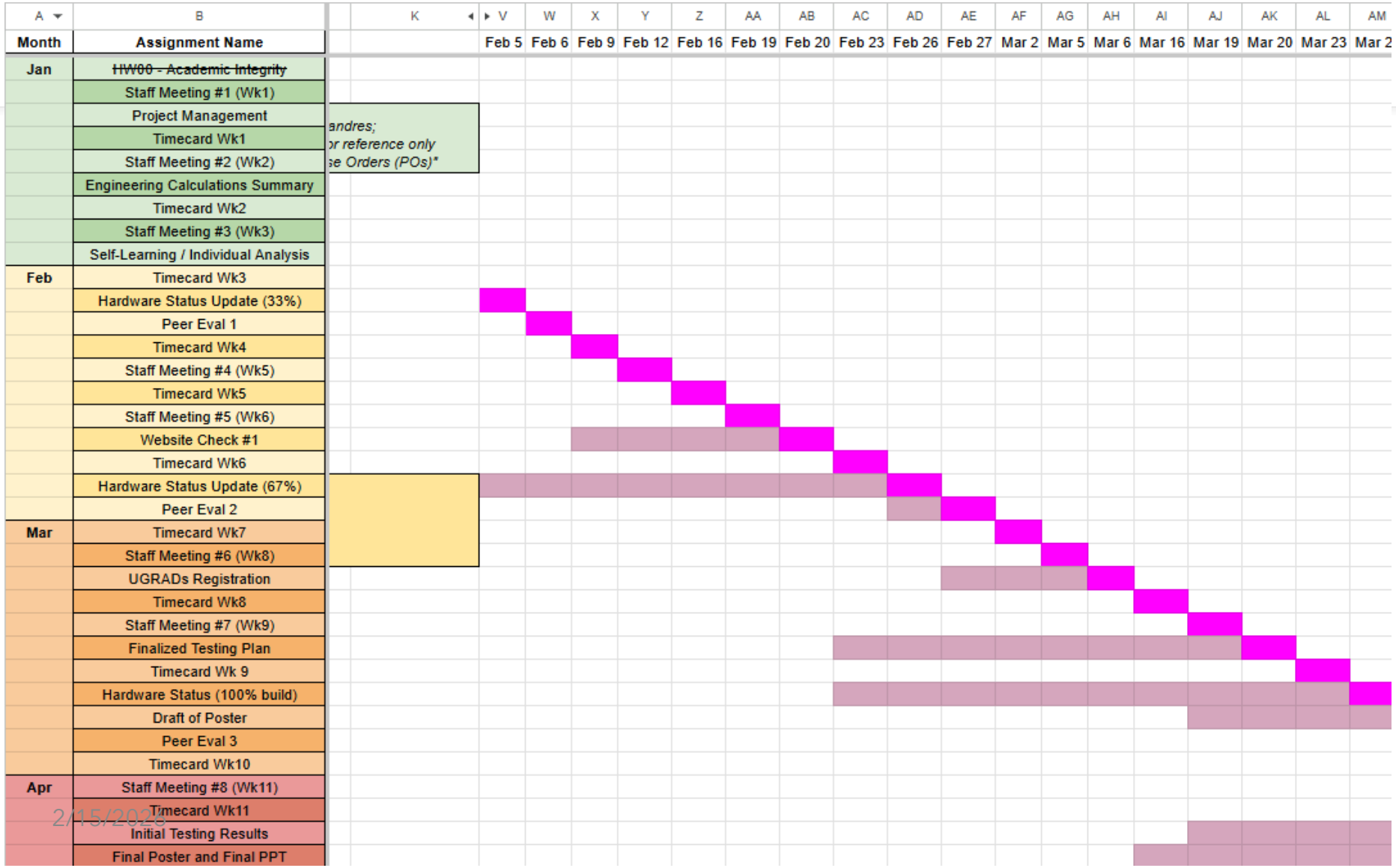
```
// PID Control Loop Configuration
myPID.SetMode(AUTOMATIC);
myPID.SetOutputLimits(PID_LIMIT_MIN, PID_LIMIT_MAX); // limits in microsteps
myPID.SetSampleTime(PID_SAMPLE_MS);

// Sensor Read & Calculation
uint16_t mm = sensor.readRangeContinuousMillimeters();

if (!sensor.timeoutOccurred() && mm < 1200) {
    myPID.Compute();
    target_step_pos = (int32_t)control_output;
}
```

Physical Builds

Gantt Chart & Schedule



Month	Assignment Name
Jan	~~HW00 - Academic Integrity~~
	Staff Meeting #1 (Wk1)
	Project Management
	Timecard Wk1
	Staff Meeting #2 (Wk2)
	Engineering Calculations Summary
	Timecard Wk2
	Staff Meeting #3 (Wk3)
	Self-Learning / Individual Analysis
Feb	Timecard Wk3
	Hardware Status Update (33%)
	Peer Eval 1
	Timecard Wk4
	Staff Meeting #4 (Wk5)
	Timecard Wk5
	Staff Meeting #5 (Wk6)
	Website Check #1
	Timecard Wk6
	Hardware Status Update (67%)
	Peer Eval 2
Mar	Timecard Wk7
	Staff Meeting #6 (Wk8)
	UGRADs Registration
	Timecard Wk8
	Staff Meeting #7 (Wk9)
	Finalized Testing Plan
	Timecard Wk 9
	Hardware Status (100% build)
	Draft of Poster
	Peer Eval 3
	Timecard Wk10
Apr	Staff Meeting #8 (Wk11)
	Timecard Wk11
	Initial Testing Results
	Final Poster and Final PPT

Feb 5 | Feb 6 | Feb 9 | Feb 12 | Feb 16 | Feb 19 | Feb 20 | Feb 23 | Feb 26 | Feb 27 | Mar 2 | Mar 5 | Mar 6 | Mar 16 | Mar 19 | Mar 20 | Mar 23 | Mar 2

Client meeting in March

Thank You